Appendix 5.7-B

A Comparison of the Years 2002-2003 With the Years 1989-2001, Using Historic Data on Winter Waterbirds

APPENDIX 5.7-B
A COMPARISON OF THE YEARS 2002-2003 WITH THE YEARS 1989-2001, USING HISTORIC DATA ON WINTER WATERBIRDS

ANALYSIS OF AUDUBON CHRISTMAS BIRD COUNTS AND MASSWILDLIFE'S WINTER WATERFOWL SURVEYS

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ESS Project No. E159

October 24, 2003

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EXECUTIVE SUMMARY

An extensive avian field survey program was initiated by Cape Wind Associates' (CWA) consultants in 2001 following consultation with Federal and State agencies in order to assess the proposed Cape Wind Energy Project's potential for impacting avian resources in Nantucket Sound. These field surveys have provided detailed baseline data on the avian community in Nantucket Sound. Prior to 2002, little avian research had been conducted in the vicinity of the Cape Wind Project study area, raising some question as to whether or not the data collected by CWA in 2002 and 2003 are representative data sets.

In order to address whether 2002 and 2003 could be considered "typical" years for avian use of Nantucket Sound, existing databases from independent and impartial entities were reviewed to compare avian activity in 2002 and 2003 with avian activity over a longer historical period of time. The available existing databases in the vicinity of the Cape Wind Project study area focused on winter waterbird and waterfowl inventories. These databases included the MassWildlife/USFWS winter waterfowl inventory and National Audubon Christmas Bird Count (CBC) data. The data on winter waterbirds from these inventories for the years 2002 and 2003 were compared to data collected from these inventories over a 13-year period (1989-2001).

These inventories were evaluated to determine whether the total abundance levels for each species in 2002 and 2003 fell within the 95% confidence interval about the mean for each species during the previous 13-year period, or whether the data from 2002 and 2003 were above or below this interval. If the total number of a species observed in 2002 or 2003 fell within or above the 95% confidence interval identified above, these data would be considered typical of winter abundances because they indicate that the same number or more birds were present in the years 2002 and 2003 compared to the previous 13 years.

Overall, this analysis demonstrates that the number of waterfowl and other waterbirds reported in Audubon CBCs and MassWildlife surveys during the winters of 2002 and 2003 were not atypical; instead, they represented typical abundance levels when compared to the abundance levels reported over the previous 13-year period. For the most part, the numbers of each species or each species group in 2002 and 2003 were within or above the 95% confidence intervals for the previous 13-year survey period. This was the case for, at least 12 of 16 species examined using the CBC data. Only one species from the CBC data (great black-backed gull) and one species from the MassWildlife data (long-tailed ducks) fell below those levels. For all other species, at least one of the years (either 2002 or 2003) had abundance levels that were within or greater than the 95% confidence interval for the previous 13 years, suggesting that abundances during 2002 and 2003 likely reflect typical abundances.

Based on this analysis, it can be inferred that the CWA 2002 and 2003 avian field surveys were conducted in Nantucket Sound when waterfowl and waterbird species were present in generally typical numbers and reflect abundances that are not different from those found in most years. Thus, surveys conducted by CWA in 2002 and 2003 would likely be reliable and valid indicators of the abundance of winter waterbird species in this area.

The results of this analysis address the concerns of those who believe a minimum of three years of research is necessary to understand the life history of avian species in and around the area, as well as those who have suggested that the years 2002 and 2003 were atypical from historical populations in the Cape Wind avian field study area. By examining 13 years of historical data from well-respected sources used for crucial wildlife management measures and species status, this analysis indicates that the years 2002 and 2003 could be considered typical years for winter waterbird abundance in the general vicinity of the Cape Wind Project. Therefore, the winter avian data collected by CWA in 2002 and 2003 should represent typical abundance levels for winter waterbirds in Nantucket Sound. In addition, this analysis shows that the two years of field research conducted by CWA should be considered a sufficient time period to make confident assumptions on the life history of winter waterbirds within Nantucket Sound and the Cape Wind Project Study Area.

1.0 INTRODUCTION

In November of 2001, Cape Wind Associates LLC (CWA) applied for Federal and State permits to construct and operate a 420-megawatt (MW) renewable energy generation facility in the offshore waters of Nantucket Sound. The proposed project involves installation of 130 wind turbines and associated infrastructure necessary to transmit electricity to the regional power grid on Cape Cod.

An extensive avian field survey program was initiated by CWA in 2001 following consultation with Federal and State agencies since there was limited existing or historical data available on avian species specifically in Nantucket Sound. One component of these avian field surveys included collecting data on abundance, density, behavior, and seasonal occurrence of winter waterbirds within the Proposed Alternative Site and other alternatives in Nantucket Sound and in the areas immediately surrounding these sites. These data were collected to characterize the potential risk to these species from the proposed development. Data were collected during the winters of 2002 and 2003 and the results are presented in Appendices 5.7-D and 5.7-G. Avian surveys were also conducted during other seasons to collect data on abundance, density, behavior, and seasonal occurrence and are presented in Appendices 5.7-E, 5.7-F, 5.7-H and 5.7-I.

The CWA avian surveys have provided two years of detailed baseline data pertaining to the avian environment within Nantucket Sound. However, during the public scoping and comment period, some have suggested that a minimum of three years of baseline data is necessary to understand the life history and use patterns of avian species in the Nantucket Sound area. Questions have also been raised whether the number of birds present during the winter season of 2002 and 2003 is consistent with or similar to historical numbers present in previous winter seasons in the same general area. These concerns were based partially on the unusually warm temperatures experienced during the winter of 2002, estimated to be the warmest winter on record in New England. Therefore, concerns were raised whether the data collected during the winter of 2002 would be representative of a typical year based on historical observations.

In order to address whether 2002 and 2003 could be considered "typical" years for avian use of Nantucket Sound, existing databases from independent and impartial entities were reviewed to compare avian activity in 2002 and 2003 with avian activity over a longer historical period of time. The available existing databases in the vicinity of the Cape Wind Project focused on winter waterbird and waterfowl inventories. These databases included the Massachusetts Department of Environmental Management - Division of Wildlife (MassWildlife) / United States Fish and Wildlife Service (USFWS) winter waterfowl inventory and the National Audubon Society Christmas Bird Count (CBC) data. The data on winter waterbirds from these inventories for the years 2002 and 2003 were compared to data collected from these inventories over a 13-year period (1989-2001).

Although these datasets do not cover the same exact location as the Cape Wind avian field study area, they do contain data in the same general vicinity, cover a very large geographic area, focus on many of the same species, and provide the best and only long-term datasets available for comparing recent data with historical data. This assessment served as the best way to evaluate whether the years 2002 and 2003 could be considered typical years for avian abundance in the general vicinity of the Cape Wind Project. In addition, this analysis used accepted datasets collected by independent and impartial entities (Audubon, MassWildlife, and USFWS) and provided a measure to test whether the 2002-2003 data collected by CWA in Nantucket Sound could be considered representative and typical for winter waterbirds in the region.

2.0 DESCRIPTION OF DATASETS AND DATA ANALYSIS

2.1 MassWildlife/USFWS Winter Waterfowl Inventory

MassWildlife surveyed the coastal winter waterfowl population in Massachusetts until 2000, when responsibility for the inventory was turned over to the USFWS. Prior to 2000, MassWildlife conducted the aerial surveys and reported the data to USFWS. For the past four years (2000-2003), MassWildlife has conducted the aerial surveys in conjunction with the USFWS. During each aerial survey flight, observations of winter waterfowl species were recorded by GPS and on audiotape. Flights were usually flown in mid-January, were weather dependent, and were in close proximity to the shoreline (~1 mile).

The MassWildlife database was used in this comparison analysis since MassWildlife was the original agency to compile the data. Data analyzed included only those MassWildlife survey sites that are in the general vicinity of the Cape Wind Project study area and only those species observed during CWA 2002 and 2003 field surveys. MassWildlife regions evaluated for this data analysis included: Inner Buzzards Bay, Elizabeth Islands, Martha's Vineyard, Monomoy, Morris Island to Woods Hole, and Nantucket.

2.2 Audubon Society Christmas Bird Count Data

The Audubon Society's CBC has been conducted annually in early winter for the last century. The CBC is the longest running and geographically largest long-term database for winter birds in North America and is used for various conservation and scientific purposes. The counts take place on specific dates within approximately 10 days of Christmas and at specific and historically determined survey sites. Each CBC includes a circular area with a radius of 7.5 miles (Table 1). The CBC database is available through the Audubon website. Detailed instructions are dispersed to participating parties on how the data are collected and compiled. For the counts used in this analysis, a range of approximately 10-100 citizens participated per count circle. A total of seven CBCs were examined (Table 1) ranging from Truro to Buzzard's Bay along the south shore of Cape Cod. Also included were sites on Martha's Vineyard, Nantucket and Tuckernuck Islands. Only those survey sites that are in the general vicinity of the Cape Wind Project study area and only those species observed during CWA 2002 and 2003 field surveys were included in this comparison analysis.

Table 1
Geographical Locations of Center of CBC Sites

Location	Latitude	Longitude
Truro	40^0 55'	-70^0 22'
Mid Cape	41^0 42'	-70^0 17'
Buzzards Bay	41^0 39'	-70^0 37'
Cape Cod	41^0 43'	-69^0 59'
Martha's Vineyard	41^0 21'	-70^0 38'
Nantucket Island	41^0 17'	-70^0 05'
Tuckernuck Island	41^0 19'	-70^0 22'

2.3 Data Analysis

As part of this comparative analysis, individual species data from the MassWildlife and Audubon CBC inventories were compiled separately by year and by geographic region. Next, all regions were pooled by year and species. The total was then compiled by species observed per year for all regions. There were a total of sixteen species from the Audubon CBC data and a total of four species from the MassWildlife data that corresponded to the regions in the general vicinity of the Cape Wind study area. Totals were calculated for each year from 1989-2003 for each species or species group. The mean, standard deviation, and the 95% Confidence Interval about the mean were calculated for each species over the 13-year period (1989-2001). The totals for each species in the years 2002 and 2003 were reported separately for each of these years. Next, a graph was created to express the statistical parameters for each species over the 13-year period compared to the totals reported for the years 2002 and 2003. The species mean and the 95% Confidence Interval for 1989-2001 were plotted, along with two points expressing the total observed numbers for each species for 2002 and 2003. The graphs are presented in Appendix 1.

3.0 STATISTICAL METHODOLOGY

Analysis of the MassWildlife and Audubon CBC data were used to verify that the survey years 2002 and 2003 were not atypical due to weather or other environmental factors. The statistical comparison analysis was designed to examine whether the numbers of waterfowl and other waterbirds counted during MassWildlife, USFWS, and Audubon surveys in 2002 and 2003 were similar to the numbers counted by these same surveys over the previous 13 years. Data were analyzed by species only for those species that were also observed during the CWA winter bird surveys. As discussed above, the observations for each year were summed to obtain a total

number observed for each species. The total number observed for each species in the years 2002 and 2003 were compared to the mean number of species observed over the 13-year period (1989-2001).

Specifically, the goal of this analysis was to determine whether the data reported in 2002 and 2003 fell within the 95% confidence interval about the mean for each species for the previous 13-year period, or whether the data from 2002 and 2003 were above or below this interval. If the total number of a species observed in 2002 or 2003 fell within or above the 95% confidence interval identified above, these data would be considered typical of winter abundances because they indicate that the same number or more birds were present in the years 2002 and 2003 compared to the previous 13 years. This provides a conservative means of estimating potential risk because the same number or more birds are present than typical years. If, however, the total number of a species observed in 2002 or 2003 was below the 95% confidence interval identified above, these data would be considered to be atypical of winter abundances because they indicate that less birds were present in the years 2002 and 2003 compared to the previous 13 years.

4.0 RESULTS

The results of the statistical analyses are presented in Table 2. To describe whether the data points from 2002 and 2003 for each species or species group was greater than, within, or less than the 95% confidence interval about the mean for the 13-year period between 1989 and 2001, the terms "Greater", "Within", and "Less" are used.

Table 2
Results of Statistical Analyses

	CBC Results		MassWildlife Results		Comparison to 95% Confidence Interval
Species	**2002**	**2003**	**2002**	**2003**	
Red-throated Loon	Greater	Within			+/0
Common Loon	Within	Greater			0/+
Northern Gannet	Within	Greater			0/+
Great Cormorant	Greater	Less			+/-
Double-crested Cormorant	Greater	Greater			+/+
Common Eider	Greater	Greater			+/+
Eiders [1,2]			Within	Within	0/0
Long-tailed Duck	Greater	Greater			+/+
Long-tailed Duck			Less	Less	-/-
Black Scoter	Within	Greater			0/+
Surf Scoter	Less	Within			-/0
White-winged Scoter	Within	Within			0/0
Scoters [2]			Within	Within	0/0
Red-breasted Mergansers	Within	Less			0/-
Mergansers [3]			Within	Less	0/-
Bonaparte's Gull	Within	Within			0/0
Herring Gull	Within	Less			0/-
Great Black-backed Gull	Less	Less			-/-
Black-legged Kittiwake	Greater	Within			+/0
Razorbill	Within	Greater			0/+

Notes:
[1] Eiders assumed to be Common with possibly a few King Eiders
[2] Data collected to the genus not individual species level
[3] Mergansers assumed to be Red-breasted

In 2002, 11 species were within the 95% confidence interval about the mean for the 13-year period between 1989 and 2001 (95% confidence interval), while six species were greater and three species were less than this 95% confidence interval. In 2003, seven species were within, seven species were greater and six species were less than the 95% confidence interval.

The CBC counts for common eiders for both 2002 and 2003 were greater than the 95% confidence interval and MassWildlife counts for eiders were within the 95% confidence interval for both years. Based on these results, eider abundance during 2002 and 2003 is considered to be typical or greater than the abundance reported between 1989 and 2001. The CBC data suggest that significantly more birds were observed and probably present during 2002 and 2003 compared to the 13 previously sampled years. The CBC counts for common and red-throated loons in 2002 and 2003 were also greater or within the 95% confidence interval.

Most of the scoter counts in 2002 and 2003 were within the 95% confidence interval which shows that their abundance is comparable to the mean abundance reported between 1989 and 2001. Exceptions to this include the CBC data for the surf scoter and black scoter. The surf scoter totals in 2002 were less than the 95% confidence interval and the black scoter totals in 2003 were greater than the 95% confidence interval. Overall, in the last two years scoter species have maintained relatively typical abundance levels compared to the abundance levels reported over the previous 13-year period.

Prior to the 2001 CBC surveys, long-tailed ducks were referred to as oldsquaws. Long-tailed duck numbers for the CBC were well above the 95% confidence interval for both years, which shows that more individuals were observed during 2002 and 2003 counts. The large numbers observed in 2002 and 2003 are a result of surveys at Nantucket and Tuckernuck, where individuals are usually observed flying over the islands to and from their feeding grounds on Nantucket Shoals at dawn and dusk (Veit and Petersen, 1993). The MassWildlife data for long-tailed ducks, however, indicate that both 2002 and 2003 totals were less than the 95% confidence interval. Although MassWildlife's observations for 2002 and 2003 were considered outliers and/or below normal years, the percentage below the 95% confidence interval is relatively small; only a few hundred birds below the data range.

The CBC counts for the northern gannet and razorbill were within the 95% confidence interval in 2002 and greater than the 95% confidence interval in 2003 indicating typical or greater abundance levels over the last two years compared to the abundance levels reported over the previous 13-year period. The total abundance of the black-legged kittiwake, bonaparte's gull, and both species of cormorants were generally greater or within the 95% confidence interval for both 2002 and 2003, with the exception of the 2003 totals for great cormorants which were less than the 95% confidence interval. Again, these data trends indicate that 2002 and 2003 abundance levels were generally typical or greater than the abundance levels reported over the previous 13-year period.

The CBC and MassWildlife data for mergansers indicate that in 2002, merganser counts were within the 95% confidence interval; whereas in 2003, merganser counts were less than the 95% confidence interval. The CBC data for herring gulls also followed this pattern with 2002 totals falling within the 95% confidence interval and 2003 totals falling below the 95% confidence interval.

Aside from the MassWildlife long-tailed duck results discussed above, the great black-backed gull was the only other species with abundance levels less than the 95% confidence interval in both 2002 and 2003.

5.0 DISCUSSION

Overall, this analysis demonstrates that the number of waterfowl and other waterbirds reported in Audubon CBCs and MassWildlife surveys during the winters of 2002 and 2003 were not atypical; instead, they represented typical abundance levels when compared to the abundance levels reported over the previous 13-year period. For the most part, the numbers of each species or each species group (Table 2) in 2002 and 2003 were within or above the 95% confidence intervals for the previous 13-year survey period. This was the case for, at least 11 of 16 species examined using the CBC data.

Of the species observed (Table 2), only the great black-backed gull, which is not considered a sensitive species, was observed in the CBC surveys to have abundance levels in 2002 and 2003 that were less than those found in the 13-previous years. The MassWildlife survey data for long-tailed ducks indicated that total abundance in 2002 and 2003 for this species was also less than that found during the previous 13-year period. However, the Audubon CBC data for the long-tailed duck show that 2002 and 2003 abundance levels are much greater than previous years. For all other species, at least one of the years (either 2002 or 2003) had abundance levels that

were within or greater than the 95% confidence interval for the previous 13 years, suggesting that abundances during 2002 and 2003 likely reflect typical abundances.

An overall conclusion from the data presented above is that waterfowl and other waterbirds reported by the Audubon CBCs and MassWildlife databases for the winters of 2002 and 2003 were, in general, not less abundant than in previous years. In fact, for some species, the numbers of birds present in the Nantucket Sound vicinity was greater than in the previous 13 years. Based on this analysis, it can be inferred that the CWA 2002 and 2003 avian field surveys were conducted in Nantucket Sound when waterfowl and waterbird species were present in generally typical numbers and reflect abundances that are not different from those found in most years. Thus, surveys conducted by CWA in 2002 and 2003 would likely be reliable and valid indicators of the abundance of winter waterbird species in this area.

It should be noted that the analyses provided above were based on Audubon CBC and MassWildlife counts that were conducted close to shore or from shore; whereas the Cape Wind Project is located several miles from shore. However, the numbers and distributions of winter waterbirds within the Cape Wind Project Area are likely to be correlated to those that were reported in the CBC and MassWildlife inventories because those databases came from a very large geographic area and are likely indicative of large geographic areas including all of Nantucket Sound. In addition, the databases that result from Audubon CBCs and MassWildlife surveys are two of the standards by which the conservation and wildlife management professionals base their decisions regarding wildlife management measures and species status. Using these databases as baselines is, perhaps, the best means of evaluating abundances and population trends of the species discussed above over large geographic areas and over the long-term.

The results of this analysis address the concerns of those who believe a minimum of three years of research is necessary to understand the life history of avian species in and around the area, as well as those who have suggested that the years 2002 and 2003 were atypical from historical populations in the Cape Wind study area. By examining 13 years of historical data from well-respected sources used for crucial wildlife management measures and species status, this analysis indicates that the years 2002 and 2003 could be considered typical years for winter waterbird abundance in the general vicinity of the Cape Wind Project. Therefore, the winter avian data collected by CWA in 2002 and 2003 should represent typical abundance levels for winter waterbirds in Nantucket Sound. In addition, this analysis shows that the two years of field research conducted by CWA should be considered a sufficient time period to make confident assumptions on the life history of winter waterbirds within Nantucket Sound and the Cape Wind Project Area.

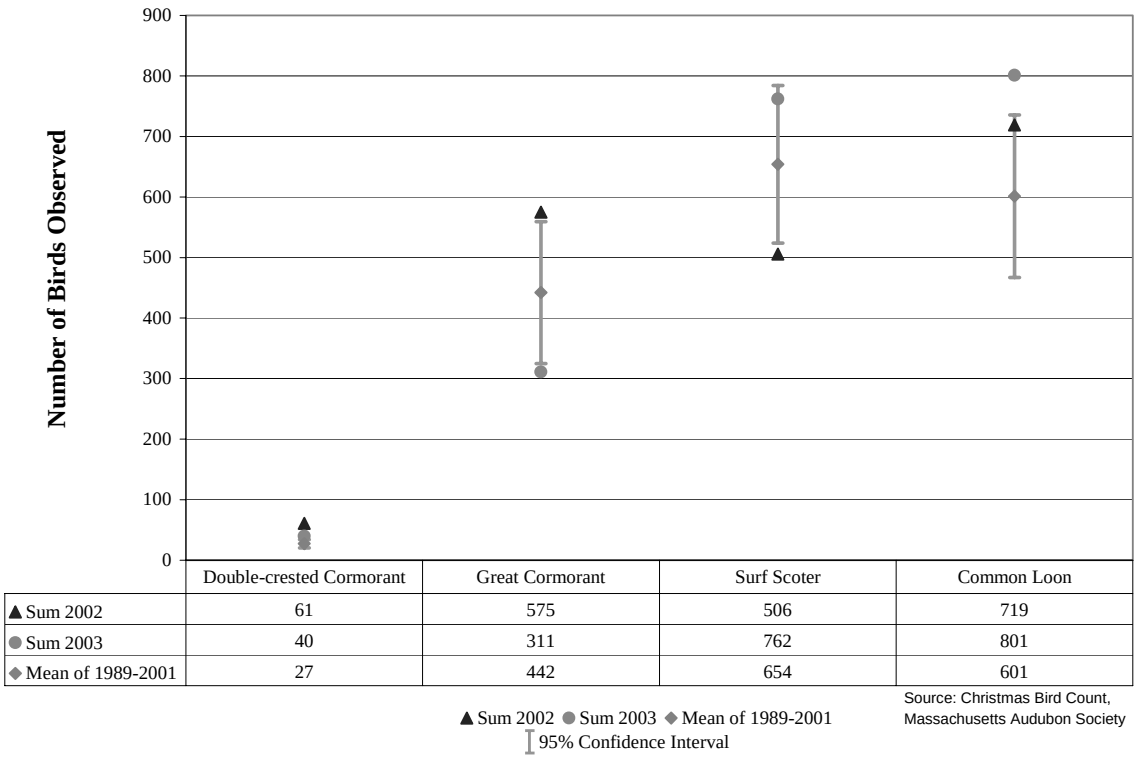
6.0 LITERATURE CITED

Veit, R.R., and W.R. Petersen. 1993. Birds of Massachusetts. Massachusetts Audubon Society, Lincoln, MA.

ATTACHMENT 1

Audubon's Christmas Bird Counts
95% Confidence Interval Graphs

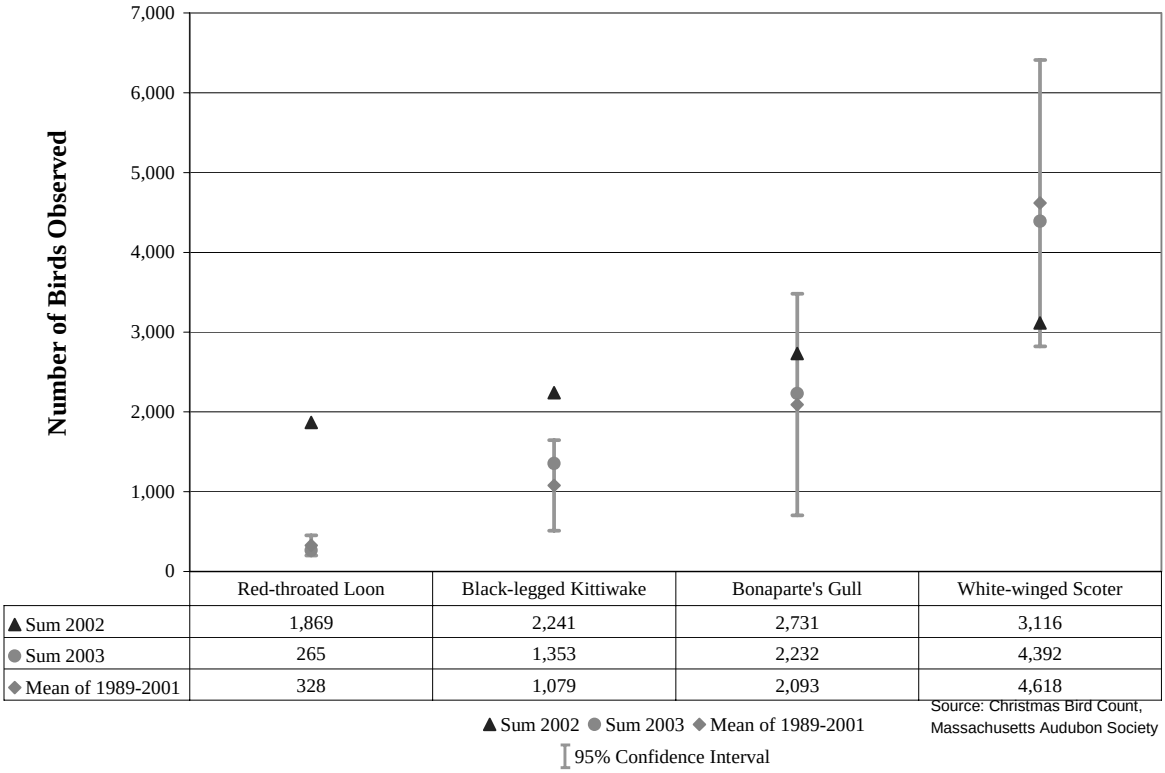
Christmas Bird Count Statistics



	Double-crested Cormorant	Great Cormorant	Surf Scoter	Common Loon
▲ Sum 2002	61	575	506	719
● Sum 2003	40	311	762	801
◆ Mean of 1989-2001	27	442	654	601

Source: Christmas Bird Count, Massachusetts Audubon Society

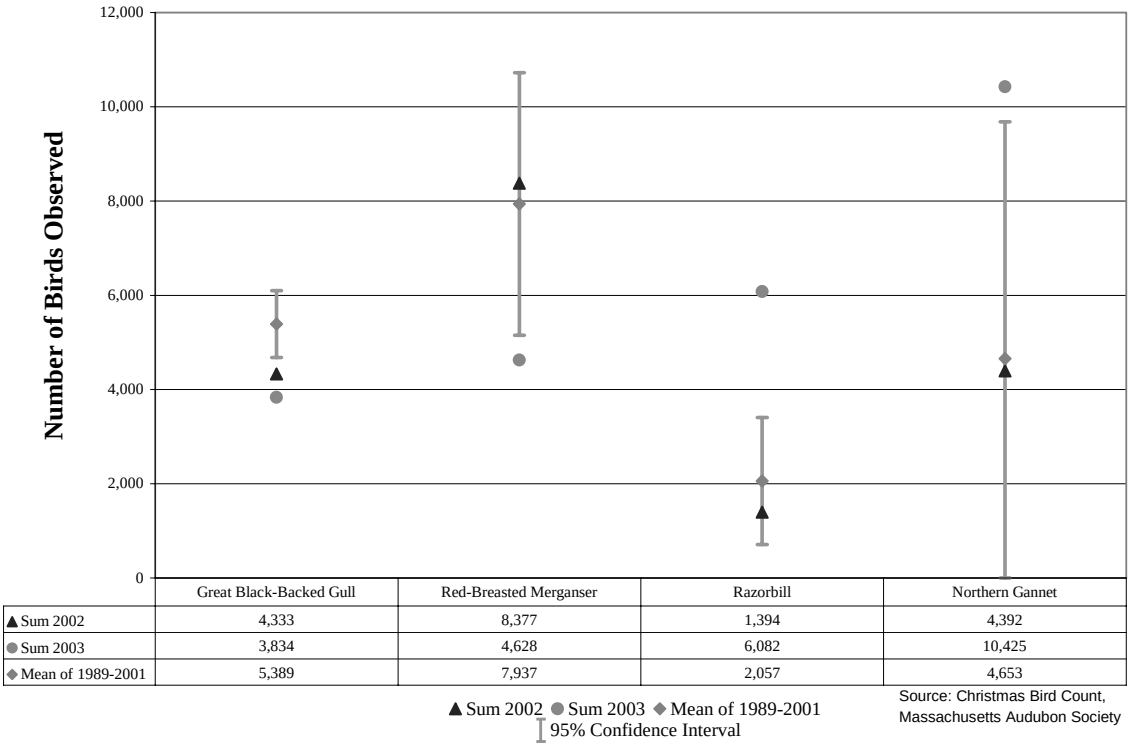
Christmas Bird Count Statistics



	Red-throated Loon	Black-legged Kittiwake	Bonaparte's Gull	White-winged Scoter
▲ Sum 2002	1,869	2,241	2,731	3,116
● Sum 2003	265	1,353	2,232	4,392
◆ Mean of 1989-2001	328	1,079	2,093	4,618

Source: Christmas Bird Count, Massachusetts Audubon Society

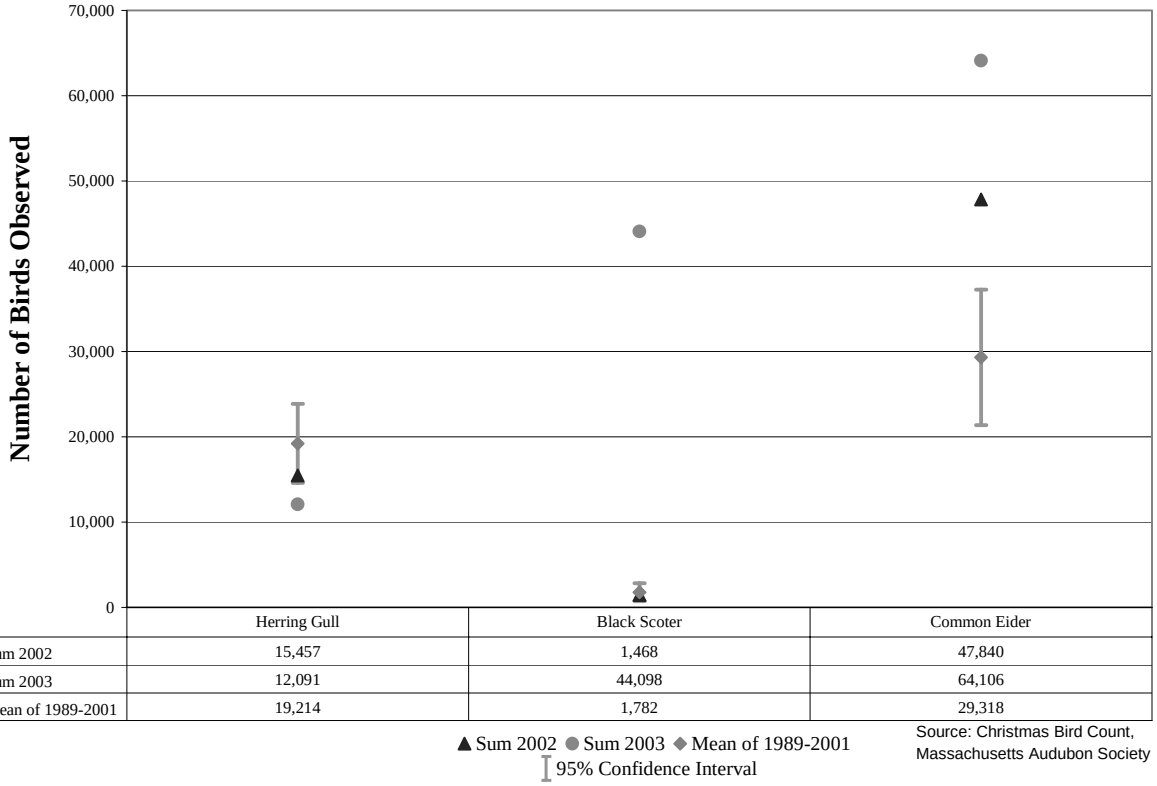
Christmas Bird Count Statistics



	Great Black-Backed Gull	Red-Breasted Merganser	Razorbill	Northern Gannet
▲ Sum 2002	4,333	8,377	1,394	4,392
● Sum 2003	3,834	4,628	6,082	10,425
◆ Mean of 1989-2001	5,389	7,937	2,057	4,653

Source: Christmas Bird Count, Massachusetts Audubon Society

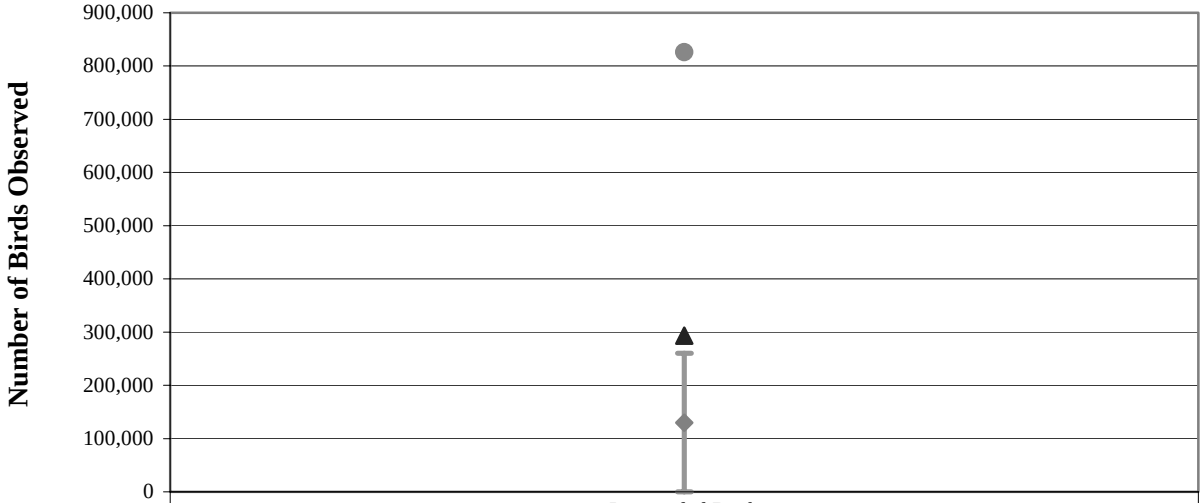
Christmas Bird Count Statistics



	Herring Gull	Black Scoter	Common Eider
▲ Sum 2002	15,457	1,468	47,840
● Sum 2003	12,091	44,098	64,106
◆ Mean of 1989-2001	19,214	1,782	29,318

Source: Christmas Bird Count, Massachusetts Audubon Society

Christmas Bird Count Statistics

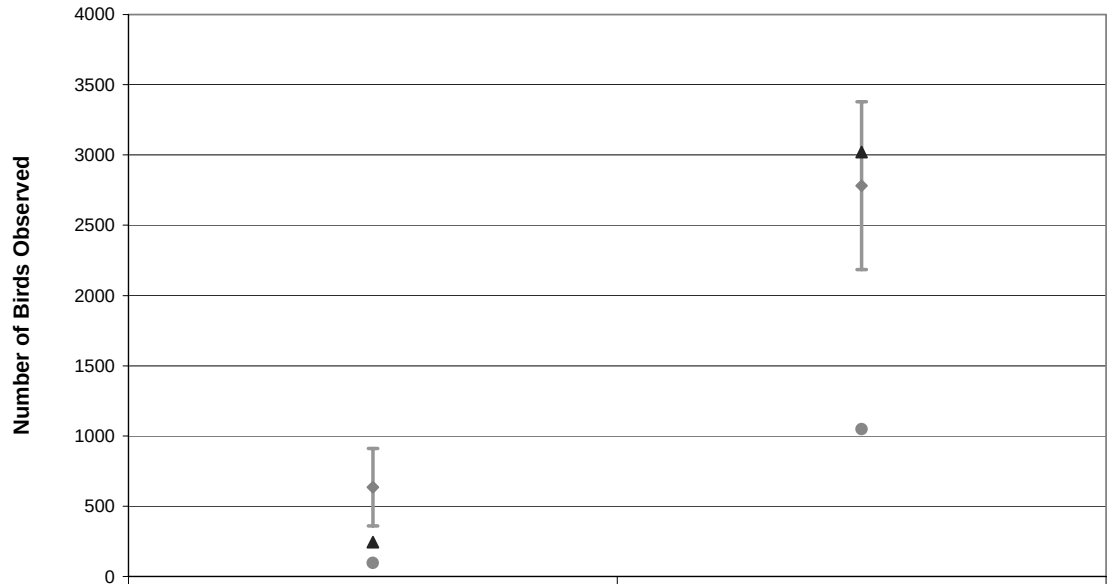


	Long tailed Duck
▲ Sum 2002	292,918
● Sum 2003	825,984
◆ Mean of 1989-2001	129972

ATTACHMENT 2

MassWildlife 95% Confidence Interval Graphs

MassWildlife Winter Waterfowl Counts



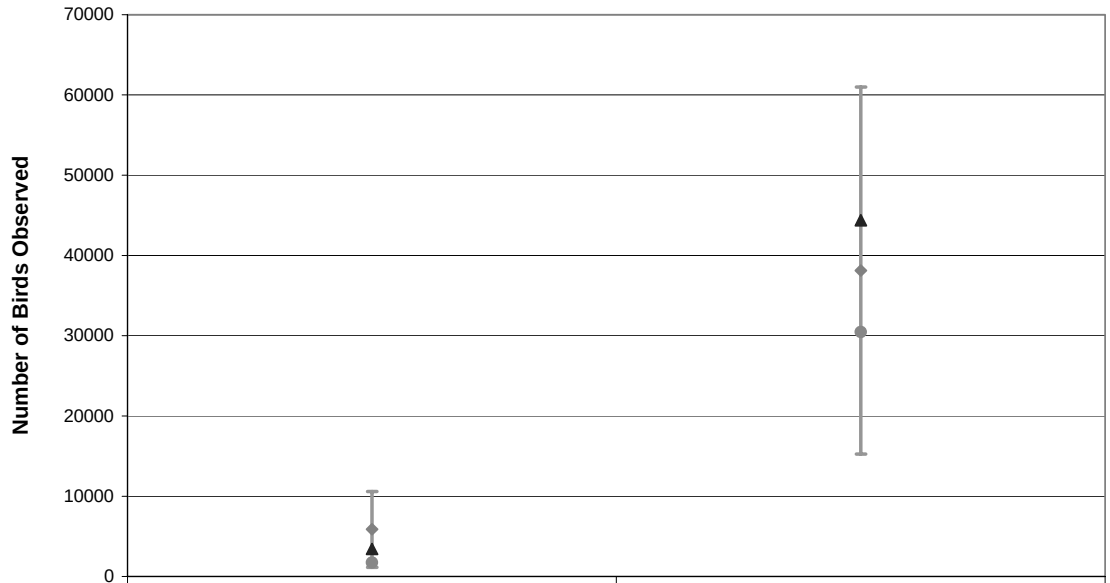
	Long-tailed Duck	Merganser
▲Sum 2002	244	3021
●Sum 2003	97	1049
◆Mean of 1989 -2001	635	2781

▲Sum 2002 ●Sum 2003 ◆Mean of 1989 -2001

I 95% Confidence Interval

Source: Massachusetts Department of Environmental Management - Division of Wildlife and United States Fish and Wildlife

MassWildlife Winter Waterfowl Counts



	Scoter	Eider
▲Sum 2002	3432	44391
●Sum 2003	1744	30469
◆Mean of 1989 -2001	5885	38125

▲Sum 2002 ●Sum 2003 ◆Mean of 1989 -2001

I 95% Confidence Interval

Source: Massachusetts Department of Environmental Management - Division of Wildlife and United States Fish and Wildlife